

PATENT COOPERATION TREATY

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PCT

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 17 NOV 2005

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| Applicant's or agent's file reference BPCL 9941 | FOR FURTHER ACTION | | See Form PCT/IPEA/416 |
| International application No. PCT/GB2004/000109 | International filing date (day/month/year) 09.01.2004 | Priority date (day/month/year) 14.01.2003 | |
| International Patent Classification (IPC) or national classification and IPC C08F10/00, C08F4/642, C08F4/70, C08F4/80, C07F7/00, C07F15/00 | | | |
| Applicant BP CHEMICALS LIMITED et al. | | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 11 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

- (sent to the applicant and to the International Bureau)* a total of sheets, as follows:
 - sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- (sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

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| Date of submission of the demand 04.08.2004 | Date of completion of this report 18.11.2005 |
| Name and mailing address of the International preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016 | Authorized Officer Parry, J Telephone No. +31 70 340- |



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Box No. I Basis of the report

- With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
 - With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-30 as originally filed

Claims. Numbers

1-25 as originally filed

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:

 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

 - the description, pages
 - the claims, Nos.
 - the drawings, sheets/figs
 - the sequence listing (*specify*):
 - any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

the entire international application,

claims Nos. 20 (in part)

because:

the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

no international search report has been established for the said claims Nos. 20 (in part)

the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

has not been furnished

does not comply with the standard

the computer readable form

has not been furnished

does not comply with the standard

the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

See separate sheet for further details

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Box No. IV Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:
 - restricted the claims.
 - paid additional fees.
 - paid additional fees under protest.
 - neither restricted nor paid additional fees.
2. This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
 - complied with.
 - not complied with for the following reasons:

see separate sheet
4. Consequently, this report has been established in respect of the following parts of the international application:
 - all parts.
 - the parts relating to claims Nos. 1-19, 20 (in part), 21-25. .

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | |
|-------------------------------|------|---|
| Novelty (N) | Yes: | Claims 5,7,9,10,13-19. |
| | No: | Claims 1-4,6,8,11,12,20 (in part), 21-25. |
| Inventive step (IS) | Yes: | Claims 1-19, 20 (in part), 21-25. |
| Industrial applicability (IA) | Yes: | Claims 1-19, 20 (in part), 21-25. |
| | No: | Claims |

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

According to the ISA, only the following subject matter has been searched:

1. Claims 1-19 and 21-25 in full and those parts of claim 20 relating to the compounds comprising metals of group 4 and 10 of the periodic table of elements.

All other subject matter of the present application has not been searched and therefore only the above mentioned subject matter under point 1 can be the subject of examination (Rule 66.1(e) PCT).

Re Item IV

Lack of unity of invention

The present application is found to contravene the requirements of unity of invention according to Art. 3(4)(iii) PCT, Art. 17(3)(a) PCT and Rule 13 PCT for the following reasons:

the general concept underlying the claims of the present application is the synthesis and use of a catalyst according to present claim 20 (feature 1) in the production of olefin polymers. However, this concept is well known (see DATABASE CHEMABS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; KAMEDA, NORIYUKI ET AL KAMEDA, NORIYUKI ET AL: "Polymerization of vinyl monomers with a dihydridorhodium complex-tetrahydrofuran system Polymerization of vinyl monomers with a dihydridorhodium complex-tetrahydrofuran system" XP002277773 retrieved from STN database accession no. 1985:46319 (D2), which describes a complex $(PPh_3)_2Rh(N(Ph)-N-N(Ph))H_2$, according to present claim 20, which is employed as a catalyst for methylmethacrylate and styrene polymerisation).

According to the present application, the problem relating to the production of said polymers can be solved in four ways, as grouped below. All these groups are linked by the afore-mentioned feature 1 as same or corresponding technical feature. However, in the light of D2, there is no single general inventive concept (Rule 13.1 PCT) and no demonstrated same or corresponding special technical feature (Rule 13.2, PCT) linking these groups:

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1. The subject matter of claims 1-16.
2. The subject matter of claims 17-19.
3. The subject matter of claim 20.
4. The subject matter of claims 21-25.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The following documents (D1-D14) will be referred to (see the ISR for the relevant passages):

- D1: WO 99/05186 A (SHMULINSON MICHAL ; TECHNION RES & DEV FOUNDATION (IL); EISEN MORIS S) 4 February 1999 (1999-02-04)
- D2: DATABASE CAPLUS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; KAMEDA, NORIYUKI ET AL KAMEDA, NORIYUKI ET AL: "Polymerization of vinyl monomers with a dihydridorhodium complex-tetrahydrofuran system Polymerization of vinyl monomers with a dihydridorhodium complex-tetrahydrofuran system" XP002277773 retrieved from STN Database accession no. 1985:46319
- D3: WALTHER, D. ET AL: "Organozirconium chemistry with inorganic donor ligands N,N'-bis(trimethylsilyl)benzamidinate (Siam) in compounds of type (Siam)2ZrX₂ (X = methyl, benzyl, allyl, chloride oder iodide) and (Siam)3ZrX (X = chloride)" JOURNAL OF ORGANOMETALLIC CHEMISTRY , 508(1-2), 13-22 CODEN: JORCAI; ISSN: 0022-328X, 1996, XP0004206125
- D4: WO 00/12568 A (COUGHLIN EDWARD BRYAN ; ITTEL STEVEN DALE (US); DU PONT (US); WANG YIN) 9 March 2000 (2000-03-09)
- D5: WO 01/55227 A (TECHNION RES & DEV FOUNDATION ; EISEN MORIS (IL); TISH EDITH (IL); VOL) 2 August 2001 (2001-08-02)

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- D6: GUZEI, ILIA A. ET AL: "Synthesis and characterization of titanium and zirconium complexes bearing diphenyltriazenido ligands" POLYHEDRON , 16(23), 4017-4022 CODEN: PLYHDE; ISSN: 0277-5387, 1997, XP0001188975
- D7: CHIU, KWOK W. ET AL: "Interaction of organic azides with methyl compounds of cobalt, rhodium, iridium, ruthenium and zirconium to give azido or 1,3-triazenido complexes. The crystal structures of tris(trimethylphosphine)azidodimethylcobal t(III) and bis(carbonyl)trimethylphosphineazidocobalt (I)" POLYHEDRON , 3(1), 79-85 CODEN: PLYHDE; ISSN: 0277-5387, 1984, XP0001188973
- D8: HILLHOUSE, GREGORY L. ET AL: "Monosubstituted triazenido complexes as intermediates in the formation of amido complexes from hafnium hydrides and aryl azides" ORGANOMETALLICS , 1(8), 1025-9 CODEN: ORGND7; ISSN: 0276-7333, 1982, XP0001188974
- D9: BRINCKMAN, F. E. ET AL: "Metal-nitrogen bonding. Covalent complexes of 1,3-dimethyltriazene with elements of Groups I, II, III, IV, and V" INORG. CHEM. , 4(7), 936-42, 1965, XP0001188971
- D10: RUIZ, JOSE ET AL: "Synthesis and characterization of chelate and bridging triazene complexes of palladium and platinum. Stereoselective oxidative addition of chlorine or iodine to [Nbu₄][Pt(C₆F₅)₂(.eta.-2-PhNNNPh)]" JOURNAL OF THE CHEMICAL SOCIETY, DALTON TRANSACTIONS , (18), 2683-2689 CODEN: JCSDAA; ISSN: 1472-7773, 2001, XP0001190862
- D11: SANCHEZ, GREGORIO ET AL: "Organonickel(II) complexes with anionic N-donor ligands. Hydration of coordinated nitriles at a nickel(II) site" HELVETICA CHIMICA ACTA , 80(8), 2477-2485 CODEN: HCACAV; ISSN: 0018-019X, 1997, XP0001161194
- D12: GOMEZ, MONTSERRAT ET AL: "Synthesis and characterization of triazeno and amidino complexes of nickel and palladium" POLYHEDRON , 12(10), 1171-7 CODEN: PLYHDE; ISSN: 0277-5387, 1993, XP0001188972

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- D13: MAJUMDAR, A. K. ET AL: "Coordination complexes of copper(II), nickel(II), cobalt(II), and cobaltn(III) with p-substituted 1,3-diphenyltriazene" JOURNAL OF THE INDIAN CHEMICAL SOCIETY , 50(11), 697-700 CODEN: JICSAH; ISSN: 0019-4522, 1973, XP0008030147
- D14: PENG, SHIE MING ET AL: "Structure of triazenido complexes cis-bis(pyridine)bis(1,3- diphenyltriazenido)cobalt(II) and nickel(II)" BULLETIN OF THE INSTITUTE OF CHEMISTRY, ACADEMIA SINICA , 32, 1-8 CODEN: BICMAD; ISSN: 0366-0370, 1985, XP0008030148

1. D1 describes the preparation of homopolypropylene and propylene-butene copolymer by means of a catalyst which is structurally very similar to those of the present application, making use of a ligand which is isolobal with the present triazenido ligands (L), namely a system comprising $(\text{Ph}-\text{C}-(\text{NCy})_2)_2\text{TiCl}_2$ and MAO. Since the catalysts are similar, the polymer produced therefrom must be the same as that produced in the present application. Hence claims 21-25 are not novel.
2. D3, like D1, describes polypropylene production using $(\text{Ph}-\text{C}-(\text{NTMS})_2)_2\text{ZrCl}_2 + \text{MAO}$.
Hence claims 21-23 and 25 are not novel,
3. D4, like D1, describes homopolypropylene and propylene copolymer production using $(\text{CH}_2)_4-(\text{NCy})_2)_2\text{TiCl}_2$ and ethylene-hexene_copolymerisation using $(\text{CH}_2)_4-(\text{CN}(\text{Ph-iPr}_2,6))_2\text{TiCl}_2$ with cocatalysts. Hence claims 21-25 are not novel
4. D5, like D1, describes propylene homo- and copolymerisation using catalysts such as $(\text{Ph}-\text{C}-(\text{N-TMS})_2)_2\text{TiCl}_2 + \text{MAO}$. Hence claims 21-25 are not novel.
5. Notwithstanding the novelty objections raised by D12 under point 12 below, the subject matter of claim 1-19 of the present application is not considered inventive for the following reasons: D1, which is considered to be the closest prior art, describes the above-mentioned catalyst system in which the subject-matter of claims 1-19 essentially differs in that an N atom replaces the central Ph-C group in the ligand of the complex $(\text{Ph}-\text{C}-(\text{NCy})_2)_2\text{TiCl}_2$ (feature 1). The technical effect of this feature has not been demonstrated. Therefore, the objective problem can only be formulated as to provide alternative catalysts for olefin polymerisation. The solution proposed in claims 1-19 of

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the present application cannot be considered as involving an inventive step because feature 1 is disclosed in D2. D2 describes a polymerisation catalyst $(\text{PPh}_3)_2\text{Rh}(\text{N}(\text{Ph})-\text{N}-\text{N}(\text{Ph}))\text{H}_2$ for MMA and styrene polymerisation. No activator is disclosed. The skilled person would regard it as a normal option to combine the teachings of D2 with those of D1 in order to solve the problem of the present application. The skilled person would also regard it as normal (for, example, see D3) to replace the substituents at nitrogen with standard groups such as adamantyl or Ph-iPr_{2,6} (present claim 19). Hence claims 1-19 are not inventive

6. D6: describes complexes with no catalytic role: L₂TiNR'2, and the Zr analogue. The substituent, R, at nitrogen is Ph. Hence claim 20 is not novel.

7. D7: describes the complexes with no catalytic role: Cp₂ZrMeL. The substituents, R, at nitrogen are Me with Ph. Me₂Co(III)(PMe₃)₂L is also described, where R = Me and p-tol. Hence claim 20 is not novel.

8. D8: describes complexes with no catalytic role: Cp*₂Hf(H)L, where R = H, Ph, or H, tol. Hence claim 20 is not novel.

9. D9: describes complexes with no catalytic role: LCu, L₄Zr, where R = Me. Hence claim 20 is not novel.

10. D10: describes complexes with no catalytic role: ammonium salts of LM(C₆F₅)₂ monomers and dimers with bridging L and neutral monodentate donor ligands where R = Ph or p-MePh. Also neutral complexes are described. Hence claim 20 is not novel.

11. D11: describes complexes with no catalytic role: LN(C₆F₅)₂ where R = Ph, 4-MePh, and 4-Meo-Ph. Hence claim 20 is not novel.

12. D12: describes the complexes: LML'X, where R = Ph, M = Ni, Pd, X = Br, L' = trialkylphosphine etc. Also perchlorate salts therof are described, and benzamido analogues. These complexes were tested for ethylene oligomerisation with or without AlEt₃, with zero result. Hence claims 1-4,6,8,11,12 and 20 are not novel.

13. D13: describes various complexes L₂M, where M= Ni,Cu,Co, and R= Ph, 4-Cl, 4-Me. They have no catalytic role. Hence claim 20 is not novel.

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14. D14: describes the complexes with no catalytic role: L₂Nipy2, L₂Copy2, where R = Ph. This document also mentions references to Cu₂L₂, Cu₄L₄, Ni₂L₄, Pd₂L₄, Pd₂L₂(allyl)2, CoL₃, phMe, and CoL₃ type complexes. Hence claim 20 is not novel.

Re Item VII

Certain defects in the international application

The nickel catalyst described in the description relates to olefin oligomerisation and thus has no bearing on the olefin polymerisation found in the present claims.

Re Item VIII

Certain observations on the international application

The following objections are made under Art. 6 (PCT):

1. Claims 1 and 19: the value z of L has no bearing on the oxidation state and valency of the metal if L is neutral

The following objections are made under Arts. 5 and 6 (PCT):

1. Present claim 20 relates to an extremely large number of possible compounds Support within the meaning of Article 6 PCT and disclosure within the meaning of Article 5 PCT is to be found, however, for only a very small proportion of the compounds claimed, namely those parts of claim 20 relating to the compounds comprising metals of group 4 and 10 of the periodic table of elements. Such compounds embrace those of the present examples.